
NASA 15055 (June 2003)
NATIONAL AERONAUTICS NASA
AND SPACE ADMINISTRATION SUPERSEDING NASA-15055
(June 2003)

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15055

WELDING MECHANICAL

06/03

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALITY ASSURANCE
 - 1.3.1 Personnel Qualifications
 - 1.3.2 Pressure Vessels Qualification
 - 1.3.3 Piping Qualifications
 - 1.3.3.1 High Pressure Piping
 - 1.3.3.2 Low Pressure Piping
- 1.4 WELDING EQUIPMENT

PART 2 PRODUCTS

PART 3 EXECUTION

- 3.1 CONSTRUCTION
 - 3.1.1 Pressure Vessels
 - 3.1.1.1 New Construction
 - 3.1.1.2 Repairs to Existing Pressure Vessels
 - 3.1.2 Piping
 - 3.1.2.1 High Pressure (125 Psig 860 kilopascal or Above)
 - 3.1.2.2 Low Pressure (Below 125 Psig 860 kilopascal)
- 3.2 HEAT INPUT REQUIREMENTS
 - 3.2.1 Preheat
 - 3.2.2 Interpass
 - 3.2.3 Postweld
- 3.3 INSPECTION/NONDESTRUCTIVE TESTING (NDT)
 - 3.3.1 General
 - 3.3.2 Pressure Vessels
 - 3.3.2.1 Test Method
 - 3.3.2.2 Acceptance Requirements
 - 3.3.3 Piping
 - 3.3.3.1 Test Method

3.3.3.2 Acceptance Requirements
3.4 PROTECTION OF ADJACENT MATERIALS

-- End of Section Table of Contents --

NASA 15055 (June 2003)
NATIONAL AERONAUTICS NASA
AND SPACE ADMINISTRATION SUPERSEDING NASA-15055
(June 2003)

SECTION 15055

WELDING MECHANICAL
06/03

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer/specifier information and will not appear in the final project specification.

This section covers work requiring steel welding. Accordingly, the specifier shall include Section 05095 WELDING STEEL CONSTRUCTION in this specification if any such welding is required.

This guide specification covers the requirements for welding of metals for mechanical use.

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

The publications listed below form a part of this section to the extent referenced:

ASME INTERNATIONAL (ASME)

ASME B31.1	(1995) Power Piping
ASME B31.3	(1999) Process Piping
ASME B31.5A	(1994) Refrigeration Piping
ASME BPVC SEC IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASME BPVC SEC V	(1995) Boiler and Pressure Vessel Code; Section V, Nondestructive Examination
ASME BPVC SEC VIII D1	(1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPVC SEC VIII D2	(1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 2 - Alternatives Rules for Basic Coverage

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC	(2000) International Plumbing Code
---------	------------------------------------

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBPVI)

NBBPVI NB-23	(1995) National Board Inspection Code
--------------	---------------------------------------

PIPE FABRICATION INSTITUTE (PFI)

PFI ES 1	(1992) Internal Machining and Solid Machined Backing Rings for Circumferential Butt Welds
PFI ES 21	(1992) Internal Machining and Fit-up of GTAW Root Pass Circumferential Butt Welds
PFI ES 3	(1981; Rev 1994) Fabricating Tolerances
PFI ES 31	(1992) Standard for Protection of Ends of Fabricated Piping Assemblies
PFI ES 35	(1993) Nonsymmetrical Bevels and Joint Configurations for Butt Welds
PFI ES 7	(1994) Minimum Length and Spacing for Welded Nozzles
PFI TB1	(1988) Pressure Temperature Ratings of Seamless Pipe Used in Power Plant Piping Systems

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01330 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal

description.

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for Welding Equipment and Welding Rods and Accessories in accordance with paragraph entitled, "Welding Equipment," of this section.

SD-04 Samples

Welder's Pre-Qualification Samples shall be submitted prior to start.

SD-06 Test Reports

Test reports shall be submitted for Radiographs.

SD-07 Certificates

Certificates for the following shall be submitted in accordance with paragraph entitled, "Quality Assurance," of this section.

Certified Welding Procedure Specifications (WPS)
Certified Brazing Procedure Specifications (BPS)
Certified Procedure Qualification Records (PQR)
Certified Welder Performance Qualifications (WPQ)
Certified Brazer Performance Qualifications (BPQ)

1.3 QUALITY ASSURANCE

Within [fifteen] [] days after receipt of Notice to Proceed, the Contractor shall submit for [approval] [review] to the Contracting Officer Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records. (PQR)

[Fifteen] [_____] calendar days prior to any employee welding on project material, the Contractor shall submit for [approval] [review] to the Contracting Officer [two] [_____] copies of each Certified Welder Performance Qualifications (WPQ) and Certified Brazer Performance Qualifications (BPQ).

1.3.1 Personnel Qualifications

This specification contains the minimum requirements for qualifying welding procedures, welders, and welding operators for making and inspecting welds in mechanical fabrications of carbon steel, low alloy steel, extra-high-strength quenched and tempered low alloy steels, and austenitic stainless steel materials.

[No pre-qualified welding procedures are allowed. Contractor shall qualify the welding procedures and welders by tests prescribed in accordance with ASME BPVC SEC IX, notwithstanding the fact the code or specification may allow pre-qualified procedures.]

Welder's Pre-Qualification Samples shall be submitted by qualified welding operators performing work on contract prior to start. Only after acceptance of samples, will qualified welding operator be permitted to begin work.

1.3.2 Pressure Vessels Qualification

Qualification documents [WPS] [BPS], PQR and [WPQ] [BPQ] shall be in accordance with ASME BPVC SEC IX.

1.3.3 Piping Qualifications

1.3.3.1 High Pressure Piping

Qualification documents for 125 psig 860 kilopascal (125 psig) or above, [(WPS) [BPS], PQR and [WPQ]] [BPQ] shall be in accordance with ASME BPVC SEC IX.

1.3.3.2 Low Pressure Piping

Refrigeration Piping: Qualification documents for below 125 psig 860 kilopascal (125 psig), [WPS] [BPS], PQR and [WPQ] [BPQ] for "Refrigeration Piping" shall be in accordance with ASME B31.5A.

Plumbing: Plumbing work shall be performed by a state licensed plumber registered in the state where the work is being performed.

Other Low Pressure Piping: Qualification documents, [WPS] [BPS], PQR and [WPQ] [BPQ] shall be in accordance with ASME BPVC SEC IX.

1.4 WELDING EQUIPMENT

Manufacturer's catalog data shall be provided for welding equipment and welding rods and accessories. Equipment shall meet referenced standards contained in this section.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 CONSTRUCTION

3.1.1 Pressure Vessels

3.1.1.1 New Construction

Contractor shall meet the fabrication, welding/brazing and inspection requirements of the [ASME BPVC SEC VIII D1] [ASME BPVC SEC VIII D2].

NOTE: Specifier should also reference any companion codes necessary to meet applicable national standards or specific project requirements.

3.1.1.2 Repairs to Existing Pressure Vessels

Code Stamped Vessels: Contractor shall meet the fabrication, welding/brazing and inspection requirements of NBBPVI NB-23.

Non-Code Vessels: Contractor shall meet the fabrication, welding/brazing and inspection requirements of NBBPVI NB-23 with the following exception:

- a. It is not necessary that a National Board Code Inspector inspect the work.
- b. National Board ("R" Stamp) Code stamping is not required.

3.1.2 Piping

NOTE: Specifier may elect to use any or all of the following fabrication guidelines. Any companion code requirements may be added at the specifier's option.

3.1.2.1 High Pressure (125 Psig 860 kilopascal or Above)

Steam Piping: Piping systems shall be fabricated, assembled and welded/brazed in accordance with ASME B31.1, and Power Piping Codes, PFI ES 1, PFI ES 3, PFI ES 7, PFI ES 21, PFI ES 31, PFI ES 35, and PFI TB1, of the Piping Fabrication Institute's companion code requirements.

Other High Pressure Piping: Other high pressure piping systems shall be fabricated, assembled and welded/brazed in accordance with ASME B31.3, and Power Piping Codes, PFI ES 1, PFI ES 3, PFI ES 7, PFI ES 21, PFI ES 31, PFI ES 35, and PFI TB1, of the Piping Fabrication Institute's companion code requirements.

3.1.2.2 Low Pressure (Below 125 Psig 860 kilopascal)

Refrigeration Piping: Piping systems shall be fabricated, assembled and welded/brazed/soldered in accordance with the ASME B31.5A.

Plumbing: Plumbing systems shall be fabricated, assembled and welded/brazed/soldered in accordance with ICC IPC.

Other Low Pressure Piping: Other low pressure piping systems shall be fabricated, assembled and welded/brazed/soldered in accordance with the ASME B31.1.

3.2 HEAT INPUT REQUIREMENTS

3.2.1 Preheat

Welding shall not be done at ambient temperature below 32 degrees F 0 degrees C, or when the surfaces are wet or exposed to rain, snow, or high wind. Temperature of the metals in the area where the welding is to be done shall be not less than 50 degrees F 10 degrees C. When the ambient conditions are such that the normal temperature of the base metal is below 50 degrees F 10 degrees C, the area surrounding the joint shall be preheated to provide a base metal temperature of 100 degrees F 38 degrees C for a distance of at least 3 inches 75 millimeter in all directions from the joint to be welded. Preheat shall be in accordance with ASME BPVC SEC VIII D1 [ASME BPVC SEC VIII D2] and ASME BPVC SEC V.

NOTE: Welding a steel which is at an initial temperature below 100 degrees F 38 degrees C may require localized preheating to remove moisture from the surface of the steel.

3.2.2 Interpass

In a multipass weld, the interpass temperature is the temperature of the weld metal before the next pass is started. Interpass requirements shall be in accordance with [ASME BPVC SEC VIII D1] [ASME BPVC SEC V] [ASME BPVC SEC VIII D2].

3.2.3 Postweld

Weldments shall not be given a postweld heat treatment unless noted in the applicable [NASA approved] code qualified/certified welding documentation, WPS, PQR and WPQ.

3.3 INSPECTION/NONDESTRUCTIVE TESTING (NDT)

NOTE: Inspection and acceptance requirements of these codes and standards are the minimum requirements. Additional inspections and tighter acceptance requirements may be used, but the

**specifier must note the additional NDT requirements
on the specifications/drawings.**

3.3.1 General

Fabrication/Erection inspection shall be performed prior to assembly, during assembly, during welding and after welding to ensure that materials and workmanship meet the requirements of the contract documents.

Each specified radiograph shall, as a minimum, have the following additional information permanently included in the image:

Agency Weld No. (including repair cycle no.)

Agency drawing No.

Agency View No.

Agency Contract No.

Final interpretation and acceptance of all Radiographs of welded joints, with the exception of code stamped pressure vessel welds, will be by the Contracting Officer.

Final acceptance of all welded/brazed joints shall be by the Contracting Officer.

Prior to the Contracting Officer's inspection, all slag and scale shall be removed from all welds. Procedure employed shall not produce notches in either the weld metal or adjacent base metal.

Unacceptable welds shall be immediately repaired and made ready for Government reinspection at no additional cost to the Government.

After weld joints have been satisfactorily completed by the Contractor and accepted by the Contracting Officer, the joint area shall be cleaned to a bright, unpitted, and unscarred surface and then protected in accordance with the contract documents.

3.3.2 Pressure Vessels

3.3.2.1 Test Method

All nondestructive testing shall be performed in accordance with the requirements of ASME BPVC SEC V.

3.3.2.2 Acceptance Requirements

Acceptance requirements shall be in accordance with [ASME BPVC SEC V] [ASME BPVC SEC VIII D2].

3.3.3 Piping

3.3.3.1 Test Method

NDT (Nondestructive Testing) of all piping systems, except plumbing systems, shall be performed in accordance with the requirements of ASME BPVC SEC V.

[For high pressure (125 psig 860 kilopascal or above) systems. Not less than 10 percent of all butt welds shall be examined fully by random radiography. Welds to be examined shall be selected to ensure that the work product of each welder or welding operator doing the production welding is included. These welds shall satisfy the acceptance standards of the specified code. If any of the butt welds examined reveals an unacceptable indication, all butt welds welded by that welder(s) shall be examined/accepted by radiography.]

3.3.3.2 Acceptance Requirements

High Pressure (125 psig 860 kilopascal or above):

- a. Steam piping systems shall meet the requirements of ASME B31.1.
- b. Other high pressure piping systems shall meet the requirements of ASME B31.3.

Low Pressure (Below 125 psig 860 kilopascal):

- a. Refrigeration piping systems shall meet the requirements of ASME B31.5A.
- b. Plumbing piping systems shall meet the requirements of ICC IPC.
- c. Other low pressure piping systems shall meet the requirements of ASME B31.1.

3.4 PROTECTION OF ADJACENT MATERIALS

Contractor shall sufficiently protect machinery, materials, floor, furnishings, finishes and other items adjacent to the welding/brazing operations to prevent any damage from these operations.

-- End of Section --